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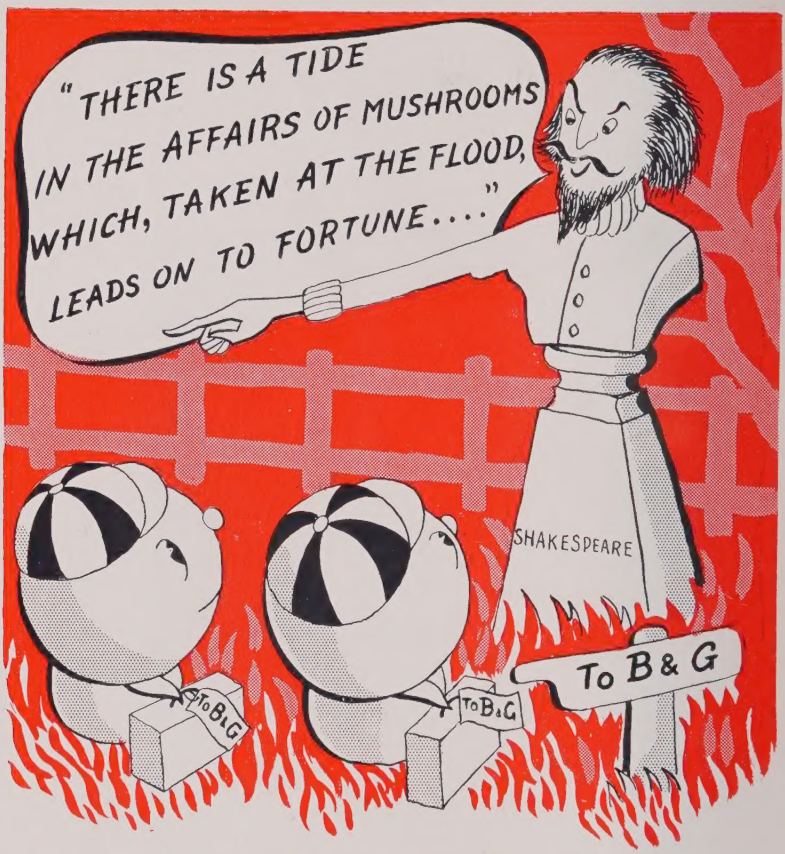
THE MUSHROOM GROWERS'
ASSOCIATION

MGA
BULLETIN

JULY, 1952 · NUMBER 31

CONTENTS

2/6



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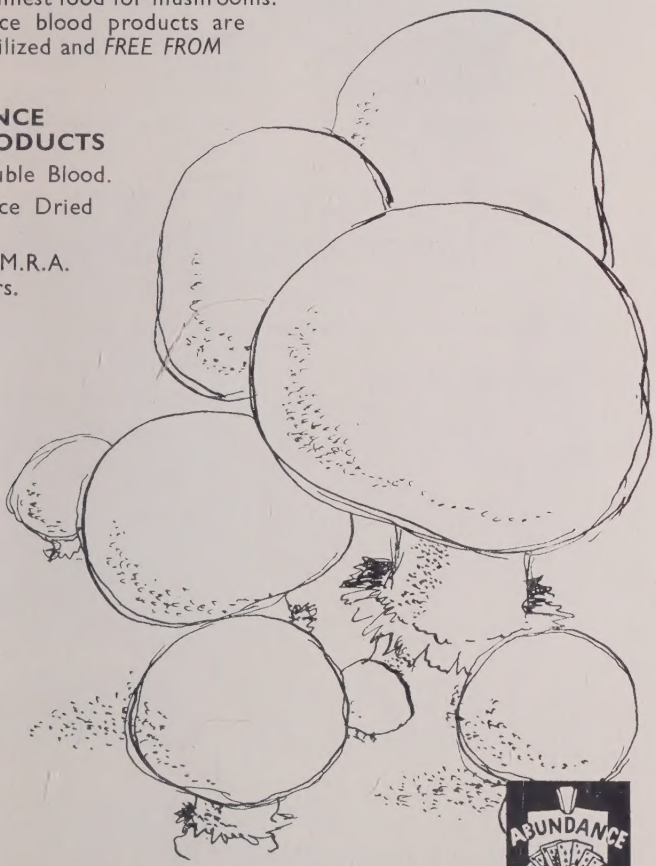

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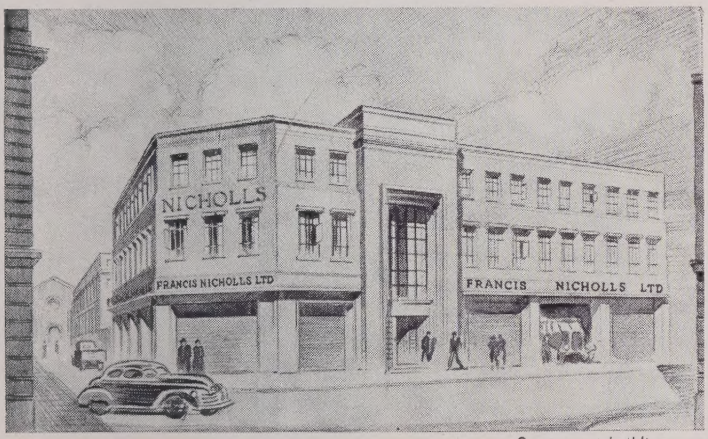

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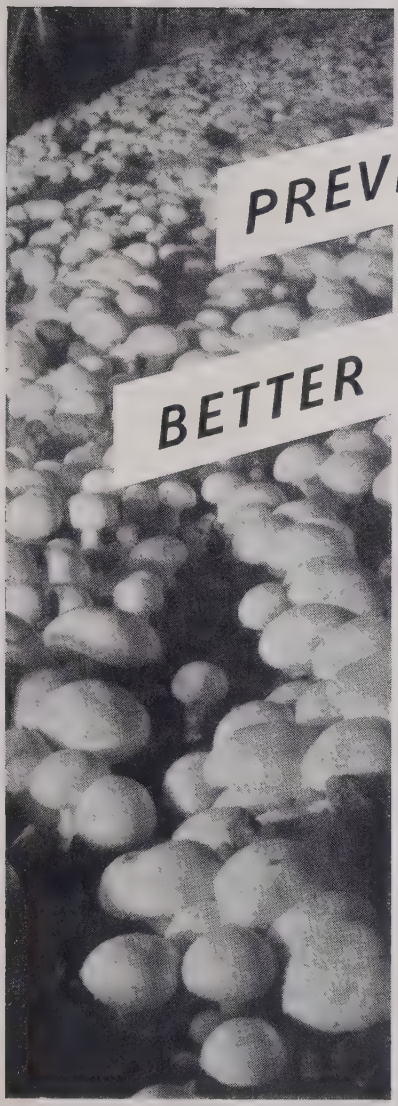

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The NEW
MGA BULLETIN

JULY 1952
NUMBER 31

EDITORIAL:

TIMES CHANGE

On another page Stanley Middlebrook presents his conclusions from a number of experiments on shorter and shorter composting. One begins to ask : " *Why compost at all?* "

Over 120 years ago, **Edward Callow** was composting in small triangular-section Middlebrookian heaps (he called them " narrow ridges "), but he turned them every other day *for three weeks to a month*, producing an excellent compost " with a degree of certainty that has in no instance failed."

Nearly 100 years ago, **James Cuthill** remarked that the market gardeners in London did not allow their manure to heat up before putting down mushroom beds *for previously-heated material does not produce such fine mushrooms.*

In 1870, **W. Robinson** supported him with this dictum : *Every gardener who makes up beds with unheated droppings knows how superior they are to fermented manure.* Though personally he preferred to give his manure one turn or to mix some good loam soil with it.

In 1886, the pendulum had started to swing back again. **J. Wright** allowed his manure to stand for four to six days before giving it its *four to six turnings on alternate days.* His was ten-day composting.

In the United States at the turn of the century, **William Falconer** described a compact oblong pile three or four feet high and well trodden to prevent " hasty and violent heating and burning." This was more like our orthodox composting in shape of stack and time taken, for the compost was *usually ready in about three weeks' time*—though after a week in the initial stack it was turned every other day !

At the same time, however, in 1897, **J. G. Gardener** of New Jersey was giving *no preparatory treatment at all.* He simply spread the fresh manure on the ground, trampled it into a solid 15" bed, and spawned 12 days later.

In 1906, **T. W. Sanders** was giving his manure only two or three turns at two-day intervals, but in 1909 he advocated more turns occupying from *ten days to a fortnight.*

Ignoring isolated reports in 1831 and the 1890's, it seems that composting for more than a fortnight did not become " orthodox " until the present century, perhaps between the two World Wars.

Which may not be helpful but is certainly surprising to some of us.

Fred C. Atkins.

THE SECRETARY'S PAGE

SUBSCRIPTION INCOME The Executive Committee has always resisted any attempt to raise the grower-membership fee, and we are now happy to announce that, to remove any unfairness, all membership will be for a period of twelve months from the date of joining. Unfortunately, with the advent of the monthly Bulletin it has been found necessary to raise the honorary membership fee to £2 2s. 0d. As these members will be receiving twelve copies of the Bulletin each year against four previously this is not an unfair move. The increase will take place from the 1st September, 1952.

AREA MEETING Is any member interested in an area meeting to take place in Covent Garden Market early one morning ? No plans have been laid yet, but suggestions will be welcome from members and market salesmen. A get-together of growers and the men who sell the produce can do nothing but good, and if the idea seems popular, a meal could be laid on, followed by a general discussion. Some interesting points of view might be heard !

HORTICULTURAL GRADUATES The Industry has always suffered from a lack of technically trained personnel to help the owner with his problems, and now we have received an invitation from the University of Nottingham which could well fill this ' long felt want.' During the month of July a number of students and trainees will be graduating. Each has had at least one year's practical training in either horticulture or agriculture before taking the course, their object being to take managerial posts. Not all of them, of course, will find either this type of post or get holdings of their own and there must be tremendous scope for such men in our Industry. One or two growers who have heard of the invitation have expressed interest and some are already in touch with the University ; any member who would like further details can have them on writing to me.

CONCERNING FOREMEN From time to time I hear of foremen who are seeking new jobs. Grower members might care to write to me when looking out for such men.

P.S. The Annual Meeting and Mushroom Lunch will almost certainly be in London on 1st October.

Angus Watson.

Stanley Middlebrook's Diary

May 10th. Now our cold store is in operation we've no mushrooms !

May 15th. How wrong we are to imagine that in hot dry weather beds need more watering. They need less, because no evaporation takes place when the outside temperature is high.

May 16th. Editor Atkins came up this morning for his annual day's holiday. I walked him on the Wharfedale fells for a couple of hours and exhausted him. He called for a pint and a halt to this foolishness. Having established myself as his superior on the physical plane, I permitted his refreshment and abandoned the rest of the walk. We motored instead. During the whole day mushrooms were never mentioned, though once or twice odd (very odd !) Bulletin suggestions slipped off F.C.A.'s tongue.

May 27th. After the hot spell the pipes are on again at night. This will circulate the air within the house and draw in cool air from without. Houses that have " stood still " should now start cropping.

June 2nd. It's about time the whole problem of spawn was thoroughly investigated. The most curious things are happening here with extensive tests of three spawns. The variations are so marked that one can no longer assume that spawn is sacrosanct. It looks as though each make has its own best environment but the makers don't or won't tell us what it is—even if they know. I suggest that the wrong spawn for any particular environment may mean a loss of anything up to 1 lb. per sq. ft. Anyway, the gentleman—the spawnmaker—who bet me a bottle of whisky should be doing something about bringing it along.

June 5th. (See May 27th.) They did !

June 7th. If you only knew it the information contained in my article on Short Composting is worth hundreds of pounds to you. It's only available because I'm a member of the M.G.A. Yet I hear at our Executive meetings that M.G.A. subscriptions must be kept down to four guineas, that growers can't afford more, that they would fall out if asked for more. I believe this is nonsense. The practical help obtainable by members in the Bulletin alone is worth 20 guineas a year. Not to mention the M.G.A.'s work, farm walks, talks, Area Meetings, Refresher Courses, the creation of a Research Station, Open Days once a month at Yaxley, etc., etc. Twenty guineas a year ? Fifty would be *cheap*. Do you or I *believe* we can't afford more than four miserable guineas a year ? If so we're hoodwinking ourselves. *Still, nobody asks us for more -we should worry !* I do complain bitterly that some few of us are giving our discoveries away for an editor's paltry cheque while others accept it all for an equally paltry four guineas. The comedy is-- WE know who are the fools !

June 8th. I had an idea Hotels were getting on to mushrooms. But after a week-end at an expensive Eastbourne hotel (all the rest were booked up) without seeing a mushroom on the menu, even at their present low price, I begin to wonder. Perhaps at these prices they have lost their " quality," their " class." Or perhaps the explanation may be phorids in the vicinity. At one farm I visited I saw millions of flies. Come on, Mr. X, get the D.034 to work !

CONTINENTAL TOUR

A party of mushroom growers spent a few days on the Continent of Europe in May, at the invitation of Monsieur Guy de Man, of Brussels, who acted throughout as host, guide and interpreter.

The growers flew from London to Brussels on Sunday, 11th May. The next day they motored to the Belgian-Dutch frontier in Limburg and visited typical examples of the vast underground limestone quarries where acres and acres of small ridge-beds in triplicate are such an astonishing sight in the flickerings of acetylene lamps.

Tuesday was equally memorable. In the morning there was sight-seeing and shopping in the nigh-incredible establishments of Belgium's royal capital. In the afternoon the growers flew to Paris and, we are told, eventually reached their beds.

On Wednesday they called on the famous spawn laboratories at Carrières-sur-Seine, where they were personally conducted through the various stages of spawn manufacture by Monsieur André Sarazin with an absence of secrecy and mumbo-jumbo which was fascinating to all who, over here, had vainly sought admission to British spawn plants.

They were particularly interested, before returning to Paris and the 'plane homewards, to see the heat room and growing chambers Monsieur Sarazin has established underground for his tray culture experimentation.

It would be an omission not to mention that in Belgium and France both food and wine were sampled—and too unkind to those who stayed at home to go into details.

Research Fund, 1952

Contributions Received to 1st June

	£	s.	d.
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Avalon Mushrooms Ltd.	2	2	0
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Jackson, R. L. O.	2	2	0
Neilsen, E. (Denmark)	1	6	0
Atkinson, W. (West Dock Timber Co. Ltd.)	1	1	0
Bankers' Orders	10	0	0
Total	£1,213	3	8

ONE of the most stimulating talks at the recent Refresher Course was that given by **STANLEY MIDDLEBROOK.** At the request of many who heard it, it is here reproduced with the more important diagrams. Our picture shows the author meeting Dr. J. W. Sinden, the American authority, in 1948, to discuss the duration of cropping. The following exclusive article reveals the outcome of their conversation.

SHORT COMPOSTING

Better Yields with Less Labour

It is hard to believe, but some people actually think that short composting is making a compost short in texture. This is not so. It is a method evolved mainly and advocated widely by Dr. Sinden, of preparing a compost in a shorter time than the usual four or five turns at weekly intervals. It produces, indeed, a far longer-textured end point than normal, and for this reason one must forget all preconceived notions of what a " well-prepared " compost should look like. Briefly, short composting is composting aerobically from beginning to end. Let me list some of the advantages :

1. Saving of compost. I find we save from 15% to 25%, not more. Certainly not up to 50% as claimed by some.
2. Saving of labour. Less compost to turn and only two or three turns of easy work against four or five of hard pulling and tugging.
3. Better and quicker crops. The " quicker " part of this item will appeal to tray men, though the main difficulty for them will be to maintain sufficient moisture in 4" depth of long, open-textured compost.
4. Less peak-heating needed. As fully aerobic conditions are encouraged during outside composting, little correction is necessary inside.
5. The knowledge that a compost can be made in a fortnight is useful if a house has to be turned out and refilled prematurely.

There are, of course, one or two disadvantages. Much more space is required for composting—about 2-3 times as much—but for less total composting time. This eating up of space presents a problem when collecting manure for future stacks.

Another important drawback is that with the traditional method of 4 weeks or so, two or three days either way are unimportant in the total. But the shorter the total time the more critical a day or even half a day can become. Week-ends and holidays can very seriously upset a compost. Half a day over or under might mean a loss of $\frac{1}{4}$ lb. per sq. ft.

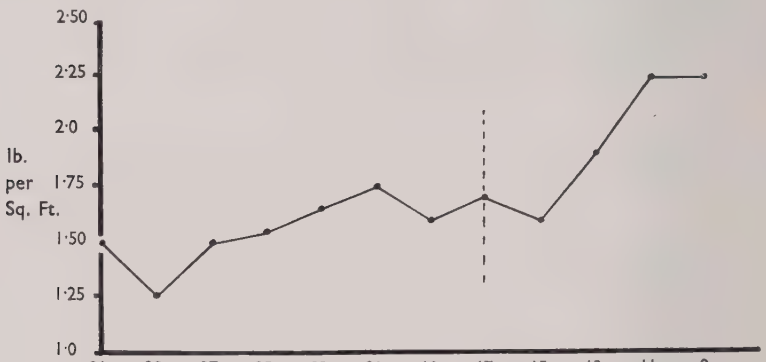


FIG. 1

BRAYTON RESULTS

The main appeal of short composting will surely be its apparent ability to produce better crops. Figure 1 shows our Brayton results from many crops at all sorts of composting times. The dotted line divides the traditional 4-5 turn square stacks on the left from the " Sinden " triangles on the right. It will be seen that there is a rise in cropping results as composting times are shortened. There does not seem to be much difference between the " traditional " crops composted from 23 down to 17 days, suggesting that these times are near the optimum for the " square " method. Equally, times around 17 and 15 days appear too long for the " Sinden " method, as cropping only starts to increase from 15 days downwards. Those are our figures, and they support Sinden's claims (to our mutual satisfaction, I've no doubt !)

How is it possible to break away from tradition and get improved results ? As I've mentioned, short composting depends on aerobic conditions throughout. Fig. 2 shows two stacks—a square and a triangle. Ignore the sizes for a moment and consider only the varying conditions in the sections, and the idea that the square represents long, and the triangle short composting. In the square stack 60% of the compost is in an anaerobic or otherwise undesirable part for 50% of the total composting time (presumably changing about every second turn), and the resulting chemical and physical unevenness has to be " corrected " by a long peak-heat in the house at " favourable " temperatures. With short composting (triangles) nearly 100% of the

stack is aerobic for 100% of the time, and little "correction" is necessary. Since it is agreed that only the aerobic parts of traditional stacks produce the best material, it is obvious that the whole process will be speeded up if all the stack is aerobic. And it can be. "Aeration," says Kligman, "is the critical factor which controls the environment within the heap." (Handbook of Mushroom Culture, p. 82). To compost quickly there must be **no anaerobic sourness at all, anywhere.** Note how the anaerobic area vanishes in the triangles ; how the desirable firefang area increases in the smaller stack ; how there are no undesirable high temperatures.

THE SINDEN TRIANGLE

What is the Sinden method ? It involves the use of roughly triangular stacks of about 7 ft. base and 5-6 ft. high for summer composting and slightly larger for winter. These figures are for outdoor composting in the U.S. with very open, strawy manure. Generally speaking, the smaller the stack the shorter may be the composting period, but this is subject to a lower limit below which it is impossible to hold any moisture or heat, and the lower limit can only be reached where there is good shelter such as a shed with protected sides. The system **demands** a thoroughly saturated manure before composting starts. This is a *sine qua non*. Turning is done at 3 or 4 day intervals, gypsum being added at the second turn along with any water adjustment. Total time is 9-13 days with a 24 hour peak-heat.

It was Dr. Sinden himself, to whom I'm eternally grateful, who started me on this system during his first visit here about three years ago. We followed his instructions carefully and results were encouraging, but we ran into trouble when we were compelled to go on to racing manure. In attempting to maintain a suitable moisture content with

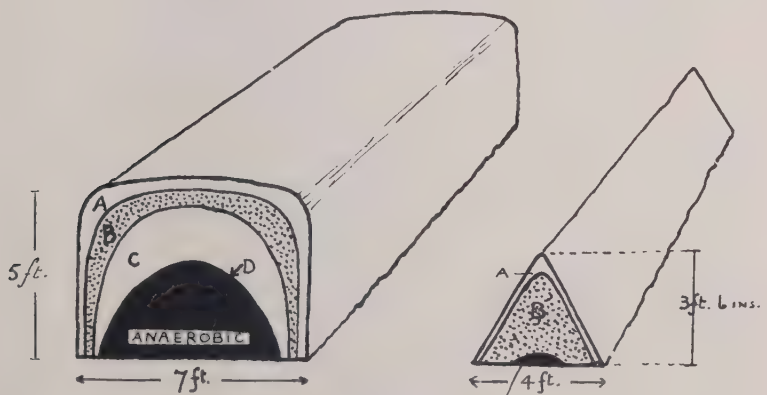


FIG. 2

A. Outside, aerobic, low temperature. B. Firefang, high temperature in squares, 120°–145 F. in triangles. C. Medium temperature, starting aerobic, later anaerobic (according to time left standing). D. Anaerobic, green, sour.

this light material we tended to pack the stacks more tightly than we should and to make them bigger. This produced higher temperatures in parts, anaerobic conditions in the bottom centre, slower composting, and a reduction in yield. We were, in fact, short composting as far as time goes but producing an under-composted end product; we had omitted the "critical factor." So we modified the system by preparing our manure for composting by first making up a traditional square stack, watering hard and trampling hard. After two or three days in this stack we turned again into another similar, again watering and trampling hard. Three days later (no more) we put it into small triangles and held it there for seven days. Then into the house. (The sizes given in Fig. 2 are those used in this adaptation.)

I should make it clear that in our two square stacks we expect no composting to take place. The stacks are too hard and too wet for too short a time. That is their purpose—to get the compost so wet that it can stand a week in a small lightly-packed triangle without drying out.

A FEW OBSERVATIONS

As we delved into our records to produce the figures of the graphs illustrated, we made one or two interesting discoveries.

First. As composting time was reduced so was the time necessary for peak-heating. So much so that in the very short times—9-11 days—results from heated and unheated composts show little difference. Peak-heating is however always done as an insurance.

Second. As composting time was shortened it was quite clear that the time taken to produce the first lb. per sq. ft. was reduced. This may seem to be cause and effect, but it is not necessarily so. One very good grower takes an inordinately long time to get his first lb. In any case it's an advantage as it is always well to get a heavy weight quickly—especially on trays. It usually indicates a good crop and, more important, gives weight before trouble starts.

Third. There would seem to be a definite relation between cropping and the average of the last two intervals before filling. (This applies to both the traditional method and to the true Sinden—not to my adaptation of the latter, where all the effective composting is done in a seven day triangle). To understand this refer to Fig. 3. This chart is difficult to follow, but I had to present it this way to get the point over.

The vertical figures—3, 4, 5, 6—are the average days of all last two intervals before filling of composts whose total composting time is indicated on the base line. For example, the average of the last two intervals of all composts that took 29 days is 6; the similar average of all 11 day composts is about $3\frac{1}{3}$ days. Those figures produce the main continuous line graph. The curve of Fig. 1 is superimposed as a dotted line (with the vertical weights omitted to avoid confusion).

It will now be possible to observe, first, that the averages of the last two intervals drop as total composting time drops. Natural and expected perhaps, but not inevitable. Second, that as that average drops the dotted crop line rises. And third, that there is a most remarkable "scissors" effect—as the average of the last two intervals goes down at any point the crop goes up, and vice versa, all the way along the chart.

This is a truly surprising effect—and it is NOT faked. I have, however, placed the two curves in close proximity to demonstrate the " scissors " effect.

After some thought, a fourth point might emerge. It would be possible to argue that the total time of composting is of little moment provided the average of the last two intervals is not too high. But this is a moot point as some might urge that with " long " composting some anaerobic conditions are required. At any rate there seems no sense in turning more times than necessary !

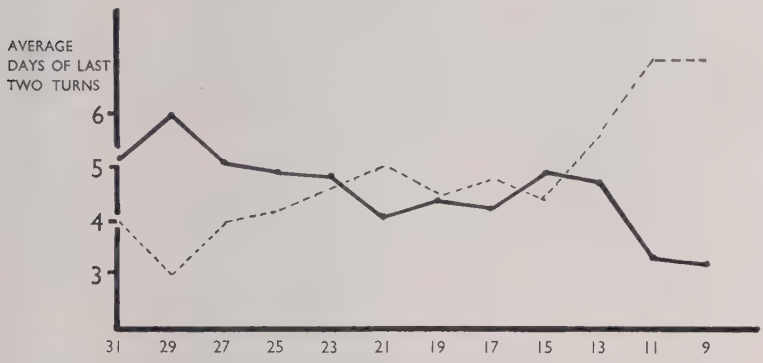


FIG. 3

J. HUNTER CARR answers some . . . . . .

JARROW FARM QUERIES

Docket System " Secrets " Explained

1. **What is the base similar to paper pulp ?**

Almost any cellulose medium is suitable for the run of mycelium. Try it and be convinced. Wash the medium and treat it with necessary trace elements. Paper, linen, jute, coconut fibre or even string will run mycelium to perfection. Reinforce with inulin, which can be obtained from dahlia tubers and Jerusalem artichokes. Inulin is a form of starch occurring in most fleshy roots.

There is some doubt as to whether a free sugar is formed during the growth of the vegetative principle. Addition of sugars does not improve the base. From over 80 independent experiments it was concluded that free sugars are not desirable in the growing medium. But certain gums are useful. They are not far removed from the sugars and starches. They also help to bind the medium to form a board.

This farm is really an experimental unit on a very large scale. The yield per sq. ft. is not high. The gain is made up on speed of cropping and superb quality.

Horse droppings contribute little or nothing to a natural compost except by way of protozoa. The urine is the dominant factor. (I will supply an analysis of urine if the Editor desires details to explain why this statement is made).

EXPERIMENT—*Tear* up a card-board box. The cheap brown board is suitable. Soak in water and trace elements. Peak heat this base as customary. Try another base of the same material but do not peak heat. Spawn as usual. Expect a good mycelium run, far better than stable manure.

2. **What are the necessary trace elements ?**

All those of the M.R.A. but in different proportions and in different combinations, e.g., chromium is added as chrome alum and copper as the salt of hippuric acid. A complex of phosphates is used and iron is introduced as both ferrous and ferric salts. A liberal supply of potassium chloride is introduced.

ALL FUNGI seem to appreciate a trace of gallium. Gallium chloride can be introduced at the rate of one-eighth of an oz. per ton of dry base. To this base add also 1 oz. sodium tungstate and $\frac{1}{4}$ oz. each of cerium oxalate (an " insoluble "), vanadium sulphate and nickel chloride. The " buffers," in keeping with molybdenum and boron of the Yaxley formula, are beryllium sulphate and cadmium chloride, each at $\frac{1}{8}$ oz.

3. **What is the casing material ?**

The casing dust comprises the dead bodies of protozoa chiefly belonging to *Suctoria*. The living organisms are reared in cement tanks and, when " fat and full," the thick brown liquid is run off and heated in sealed bins to 176° F. This effects a prime kill by rupturing living proteins. Part of the colloid is used for absorption to form the " compost " or actual growing medium. It may be regarded as concentrated food in a suitable base. The remainder is dried and crushed. This dust is the casing medium.

Pinheads soon form on the growing medium and the dust is applied as a mere covering. No depth is necessary. " Compost " and casing are similar materials.

Among the protozoa *Paramœcium* usually dominates a natural compost. It is not desirable. For this reason hay-fed horses do not yield a good stable manure compost. It is good to know Why !

The elementary book dealing with protozoology is suggested as " The Smallest Living Things "—Gary N. Calkins, Publishers, University Press, New York, No. 4.

EXPERIMENT—Make a box (say 1′ × 1′ 3″) of wood. Lay ordinary, tightly packed Yaxley artificial compost in it to a depth of only one inch. Spawn and case in the usual manner but use only $\frac{1}{2}$ inch. of soil—yield, about 10 oz. Inference : Concentrate the mediums by using extracts. Yield ? . . . Well, try it to find which is the grower of mushrooms, the brown extract or the ruffage residue.

4. **How is Peak Heating effected ?**

Orthodox peak-heating does not make a complete kill of organisms in a compost. Some of these, as resting bodies, can survive a temperature

of well over the boiling point of water. **Clostridium tetani* usually survives normal peak-heat. The presence of this anaerobic bacillus is difficult to detect and since the optimum temperature for growth is about 100° F. it can easily " poison a bed." The incubation period is from 5 to 14 days and the recently advocated Rapid Composting from dry Stable Manure becomes obvious as to its advantages.

However, the vegetative principles of all organisms are ruptured at 170° F. and the kill is made absolute in special rooms designed for the purpose. *Selected* living organisms such as those mentioned in Q. 3 are accepted only to provide for a natural process of chemical build-up of suitable compounds. Unwanted organisms are not allowed to enter.

As an illustration of this, one particular organism can produce a trace of phenyl propionate, one part of which in many million parts of a compost will attract *Chaetomium olivaceum*. This is an entirely new angle of interest as to Olive Green Mould. Try it and be convinced. Purchase a sealed bottle of this liquid direct from the chemist. Do not open the bottle but leave it in a somewhat sheltered place. The mould will appear near the sealed stopper (double sealed, in fact, because of the extra protecting covering). On the other hand phenylactic acid repels this potential competitor which is almost everywhere on a normal farm. Another substance, N—N dimethylparaphenylenediamine will kill without apparent contact. It may attack you, also it can cause a severe form of dermatitis. But try these things. Be convinced !

Personal Observations

The farm cannot, as yet, be made open to visitors. The Editor has particulars as to why the privilege cannot be granted, not even to representatives of the M.G.A. or the M.R.A. or to any other Body of a similar nature. At a later date the presence of Authorities may be desirable. In fact it may not be possible to avoid the calling in of such Authorities but, until that time, doors must remain closed against risks.

The Editor also has particulars as to why a considerable part of the secrets have been made open. It is likely that they would become public property in any case. (The correspondence in this matter is confidential—EDITOR).

In the meantime, growers have been given details of experiments they can try for themselves and prove that the Docket System, or a modification of it as very shallow beds, will be *the near-future method of Mushroom Culture.*

* This bacillus does not ferment carbohydrates. It can always be expected to be present in stable manure. It forms one of the most appalling poisons known. Details for isolation of the poison are available.

PRESS CUTTINGS

A new method of soil improvement . . . . . is based on a synthetic powder called **Krilium** and its primary effect is to form and stabilise natural soil aggregates, enabling them to hold water and soluble plant foods. *Grower*, 5.1.52.

Dr. R. L. Edwards has suggested that **electric cables** might be found worthwhile for the peak heating of ridge beds and of the very thick ground beds often found under glass.

F. C. ATKINS in *Grower*, 5.1.52.

PHILIP HARBEN concludes his series with

MUSHROOM SOUP

Mushroom Soup is the Queen of soups. I know of no other in which the flavour is at once so subtle and so satisfying. But two things are essential—the soup must be of an exquisite smoothness, and this may mean a hair sieve and hard work ; and, most important of all, *the mushrooms must be unstinted.*

There are two distinct ways of making mushroom soup. The first way for which I shall offer a recipe is the easy way and the cheap way. There is no sieve-bashing and only the stalks of the mushrooms are used. It produces a sound soup of good mushroom flavour, but is outclassed by the second recipe which is intended to produce an unusually fine soup, the very quintessence of the delicate beauty of *Psalliota bispora.*

Mushroom Soup Economical

INGREDIENTS : (4 portions). About ½ lb. mushroom *stalks* only ; 1 bay leaf ; 1 teaspoonful mixed herbs ; 1 cube or teaspoonful meat or vegetable extract (e.g. Maggi, Marmite, Bovril) ; as many raw bacon rinds as can be procured ; 2-3 oz. margarine ; 1½ oz. (about 2 flat tablespoonfuls) flour ; 1 pint milk.

METHOD : First of all proceed to make a concentrated mushroom stock by putting all the ingredients except the milk into a saucepan with water to cover. The ideal appliance to use for this purpose is a pressure cooker : you want to produce half a pint of " essence of mushroom " and if you put the ingredients into a pressure cooker with half a pint of water, no more, in ten minutes cooking you have got it. Without a

pressure cooker the work can be done in an ordinary saucepan. The cooking must be continued for at least three-quarters of an hour, and the water level maintained so that the ingredients are at all times covered. In the result you will be left with considerably more than half a pint of stock and this must be reduced to an essence by rapid evaporation. Strain the liquid off, boil it rapidly in an *open* pan so that the steam can escape freely, and keep it on the highest heat until it has boiled down to half a pint.

The stalks, of course, having yielded up their all, are discarded.

Now, in a separate pan, melt the margarine, and into it stir the flour thoroughly until you have that smooth paste that cooks call 'roux.' Into this roux stir your mushroom stock slowly, a little at a time, off the fire. Then add the milk in the same manner. Bring the soup slowly to the boil, check the seasoning, adding salt and pepper, and the soup is ready to serve.

Optional garnishes : grated cheese, chopped parsley, chopped *raw* mushroom.

Mushroom Soup de luxe

INGREDIENTS : (6 portions and some second helpings). The stalks only of 2 lb. of mushrooms (*except for one mushroom which is to be left whole*) ; this should yield $\frac{3}{4}$-$\frac{1}{2}$ lb. of stalks. 1 lb. of the stalkless mushrooms (the remainder being saved for other uses). 1 bay leaf ; 1 teaspoonful mixed herbs ; 1 cube or teaspoonful of meat or vegetable extract ; as many bacon rinds as can be procured ; 1 small onion ; $\frac{1}{4}$ lb. margarine (do not stint here—this quantity of fat is part of the secret of the soup) ; 1 oz. flour ; 4 teaspoonfuls salt ; pepper ; $1\frac{1}{2}$ pints milk. Required also : a " liquidiser " (e.g. Kenmix, Magimix or Turmix) which is essential for the very best result, or, failing this, a hair or nylon sieve.

METHOD : First of all make half a pint of mushroom essence, in exactly the same way as described in the first recipe, with the stalks, herbs, meat extract and bacon rinds. Chop the onion finely and fry it in the margarine in a saucepan. Add the flour to make 'roux,' work in the mushroom stock and the milk. So far it is very like the first recipe.

Now add the mushrooms in small pieces, cook for a few moments and pass the whole thing through the " liquidiser " or fine sieve. Return the soup to the pan, heat it and check the seasoning. Take the mushroom complete with stalk which you saved (choosing of course the finest specimen in the chip) and cut it into the thinnest possible slivers which you float *raw* upon the surface of each portion of soup. You will see the effect this produces in Mr. Edward Tanner's beautiful photograph. Unfortunately with my hands alone I could not convey the full pleasure I derived from being able to slice so thinly the very fine mushrooms which your Editor sent me for this soup and illustration ; such thin slicing can only be done with the very freshest fungi.

If you want this soup to be white you can get it so by removing the gills from the mushrooms before you use them. I preferred to leave them in, and the colour of the soup was—how shall I describe it ?—an exquisite pinkish grey ; dawn sky ; the colour of a dove's breast—no, it was more beautiful than that, it was *mushroom* colour !

THE CULTIVATED MUSHROOM–4

MORPHOLOGY *(concluded)*

By ANDRÉ SARAZIN, Licencié ès Sciences

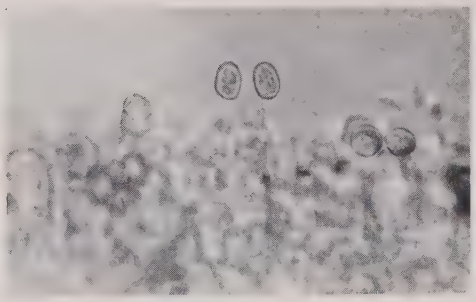


Fig. 10. Basidium with 2 spores. × 1,000.

The paraphyses, which are intercalated between the basidia, are sterile. They are passive in their function, serving as packing to separate two neighbouring basidia from each other so that the spores do not hit one another at the moment of their discharge. While they are at first of the same size as the basidia, they become differentiated from them simply by ceasing to grow, and in a fully mature carpophore by being smaller in size and incapable of producing spores. The number of true paraphyses is very small. The discharge of spores during the maturation of a carpophore is a continuous phenomenon as a result of the continuous succession in the development of the basidia each producing its quota of spores ; so much so that what might be interpreted as being a paraphysis in a young carpophore becomes actually a basidium in the course of maturation. This term paraphysis should therefore be reserved only for the structures which have remained sterile in a hymenium which has discharged its entire spore-mass.

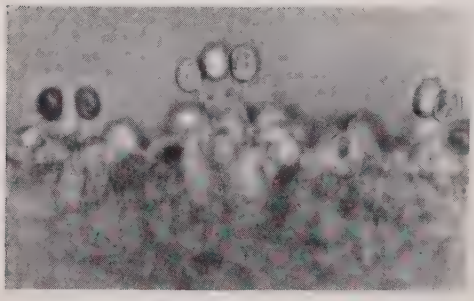


Fig. 9. Basidium with 3 spores. × 1,000.

The spores per basidium are two in number in the cultivated varieties of *Agaricus campestris*. It has already been observed that this feature serves to differentiate the cultivated mushroom from the wild agarics, whose basidia normally produce four spores. There occurs also in the cultivated mushroom a certain percentage of basidia bearing three spores (fig. 9), and a smaller number of aberrant basidia bearing either

a single spore (being twice the size of the normal spore) or four, six or even eight spores (being markedly inferior in size to the normal spore).

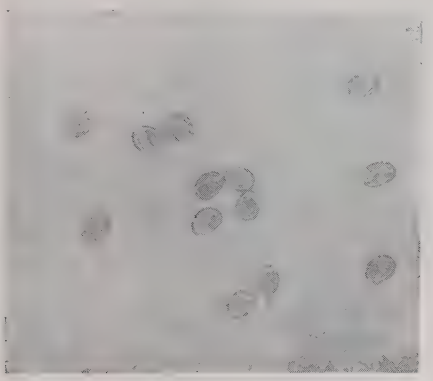


Fig. 11. Basidiospores, some of which show the hilum and the fatty particles. × 900.

The *basidiospore* or spore (fig. 11) is the unit of preservation and reproduction of the cultivated mushroom. In colour it is brown ; in its greatest diameter it measures an average of 6 to 9 microns (one thousandth of a millimeter) by 4 to 6 microns in its smallest diameter ; it is usually ovoid and slightly curved like a kidney bean along one of its edges. It always has, at the point of its sterigma, a little projection called the *hilum* or hilar appendage. On the side opposite to the hilum lies, scarcely visible, the germ pore through which the germ tube streams out on germination taking place. The coloured wall of the spore is rather thick. Under a high magnification, one or two clumps of highly refringent small fatty globules may be distinguished inside it.

The various anatomical features of the cultivated mushroom in all its stages of development have been briefly surveyed and it remains for the different phases of this development, from the germination of the spore to the formation of the carpophore, to be followed. I propose to deal with this in the next article.

The translation is by Dr. C. J. La Touche. The blocks are the property of the Author. Permission to reproduce has been obtained from the Editor of the French Federation's Bulletin.

Research Report, 1951

Now on sale at Yaxley is the M.R.A. Report for 1951. Contributors in 1951 and 1952 will have received a free copy automatically ; others will find the 5/- well spent, for this Report contains a detailed record of all the work done at the Yaxley Station last year.

The introduction alone is sufficiently stimulating to compel the serious grower to study the individual experiments and their data.

There are sections on Cropping Experiments, the Chemistry Department, Casing Soil, the Microbiology Department (with its work on Truffle control), Commercial Trials with the M.R.A. Synthetic Compost, and some Notes on the Straw Shortage and Possible Alternatives.

MY WAY OF GROWING

8.—Sir Thomas and John Lea, at Dunley Hall

'Our way of growing' is really pretty orthodox and unexciting, as well as rather inexperienced, but at the recent Area Meeting held on the farm, the Editor pointed a polite pistol at our heads, so we are handing over.

We started, like so many other people, in the cellar, and graduated to converted stables, both of which now lie empty hulks—a tribute to progress and science, for the transition from the cellar was forced on us by the effect of DDT smoke curling up through the floor boards of the dining room.

The present plant was planned as a complete unit, and built in two stages, as we were able to get licences ; it therefore has the advantage of being built for the job, without any adaptations or additions. This is the layout : Two blocks of houses in the shape of a capital L ; five houses in the long leg, and three in the short leg, with space for a fourth house in the short leg if we want it. Opposite the short leg, making the third side of an imaginary oblong, are the soil shed and lorry garage. In the centre is the boiler house, and the turning shed which is a dutch barn erection with steel uprights, and roof of asbestos. The whole of the centre area is concreted, the fourth side being protected by a strong hedge and a windbreak of poplar, so that working conditions in the turning shed are agreeable.

A concrete road runs behind the two blocks of houses, and this enables us to empty the houses, and remove butts and trashings from the

back, whilst filling and casing are carried out through the front doors on the centre yard. The layout has been designed to reduce labour costs, to be adaptable for mechanisation, and for keeping clean and sterile.

The dimensions of the houses are 56′ × 18′ with two rows of five shelf beds giving 2,500 sq. ft. in a space of 14,000 cubic ft. which has an air : bed ratio of 5 : 1. The construction is brick cavity walls filled with glass wool, and the roof, asbestos sheets on rafters, with an inner skin of asbestos sheets secured under the rafters to form the ceiling, with two inches of glass wool for insulation. We designed a pitch roof, which not only gives much better ventilation, but such condensation as there may be (which is very small) runs down the sheets and does not drip on the beds. Heating is by four-inch pipes from a coke boiler with forced circulation. The beds are galvanised sheets painted with bitumastic and easy to take down, clean and reassemble : the top two beds are picked, etc., from trolleys on rails running down the centre and both side aisles.

At present we work on a three-weekly cycle ; we fill a house every three weeks, and this with eight houses gives us a complete crop in 24 weeks, or $2\frac{1}{6}$ crops in a year. We have approached the problem from this angle, to start with, because of the economics of an absolutely regular labour programme which proceeds unvaryingly in a three-weeks pattern throughout the year.

We shall, no doubt, alter this in the light of experience when we have finally discovered the optimum composting and cropping periods for our type of manure.

All our supplies are long straw manure, 25 tons of which is stacked in two equal heaps, and each heap fills one side of a house. We have great difficulty in getting the manure wet enough at stacking, and have to use large quantities of water which runs out, and as it then contains much of value, it is collected in a drain pit and pumped back. We add 28 lb. gypsum per ton of manure at stacking, 28 lb. of Adco M at the 1st and a further 14 lb. of gypsum at the 4th (last) turn, the outsides of the heaps being dusted with BHC.

We use galvanised baths for filling, run into the house on a light railway, and take, with 6 men, about a day and a half to fill and level.

For peak heat, we use a fan blowing up vertically in the middle of the house which maintains a temperature differential of about 3° F. between the top and bottom beds, while boosting heat if needed is provided by two electric fan heaters.

At peak heat, which is usually reached in 24 or at most 36 hours, we sterilise with formaldehyde released by potassium permanganate.

Spawning is carried out when the beds get down to 75° F., and we use either manure or grain spawn, preferably the latter as it seems to be about three days quicker. The beds are cased three weeks after spawning, and cropping generally starts 42 days after spawning. We are dissatisfied with our casing soil, as it is too sandy, and very difficult to water, but we have so far refrained from changing it because, coming as it does from a deep gravel pit, it is quite free from disease, and is brought to our site very cheaply without involving us in any labour or sterilising. As we do grow mushrooms with it, we have thought it wise to stick to it for a time, while trying to get our composting and other tests right, but we are now making trials of it with additions of peat in the hope that this will hold water better, and still allow us the advantage of disease-free soil.

The pickers cut the butts off, and trim the stalks, putting the mushroom stalk upwards in 12 lb. chips ; this makes it much easier for the graders who can see exactly what type of mushroom they are picking up without having to turn it over.

The houses are emptied by a conveyor which runs down the centre aisle, and an elevator which dumps straight into a waiting lorry. Until we got this, it used to take us three days to empty and clean a house with six men, but we can now complete the job with four men in one day.

To avoid infection, we use different firms, one for emptying and one for hauling manure.

We try to maintain the sort of cleanliness routine that Dr. Edwards recommends, and with the aid of this and our almost disease free soil we have kept fairly clear of bad trouble, but our fingers are permanently crossed.

When we empty a house, we think it pays to re-whitewash the walls and spray the bed-sheets and house with formaldehyde. Every other emptying, i.e., once a year, we re-paint the bed-sheets and supports with bitumastic paint.

We keep pretty comprehensive records of each crop, from stacking to emptying, including temperature graphs at peak heating, and constantly study them in order to try and learn something. But we must end by saying we don't feel we know much about it, and we are just as astonished when we get a good crop, as we are bewildered when we get a bad one, and we find this stimulating and interesting.

When we average 3 lb. a sq. ft. and have stopped being astonished, we will ask the Editor if we may write an informative article !

(Photographs by courtesy of "The Stourport News" and Sir Thomas Lea)

NEW M.G.A. MEMBERS

Courage, Mrs. H., Edgcote, Banbury, Oxon.
Holston, Earl M., Grocery Store Products Co., Inc., Union & Adams Street, West Chester, Penna., U.S.A.
Littler, W. C., Tylers, North Weald, Essex.
Penny, A. C., 35 King Street, Covent Garden, London, W.C.2.
Pleasants, H., Woodlands House, 761 Hertford Road, Enfield, Middx.
Robinson, R. A., 16 College Road, Upholland, Wigan, Lancs.
Stuart, C. E., 46 Ludlow Road, Vredchoek Estate, Cape Town, S. Africa.
Turner, D. A., Bretby House, Hurley, Atherstone, Warwickshire.

ALTERATIONS AND CORRECTIONS

Duncan, Miss C., c/o Glaxo Laboratories Ltd., Ulverston, Lancs.
Kohn, S., Kvuzat Mazuba, Doar na Gaililmaaravi, Israel.
Rocke, Col. C., Villa da Schio, Costozza da Vicenza, Italy.
Stephenson, C. H. & F., Canal Wharf, St. Andrew's Road, Aspley, Birmingham.

Italics indicate honorary membership

DEFINING A MUSHROOM

The *Shorter Oxford English Dictionary* says : Common edible mushrooms and species that closely resemble it.

Ainsworth & Bisby's *Dictionary of the Fungi* is scarcely more precise : 1, an agaric fruit body, especially an edible one ; 2, any agaric. But it has this note under Toadstool : A common name for the fruit body of an agaric other than a mushroom.

The *British Medical Journal* (21.8.48) has referred to the subject in these words : The term " mushroom " is often used to cover all varieties of edible fungi, but it is preferable to limit it to the field or cultivated mushroom (*Psalliota campestris*). Though many edible fungi are peculiarly shaped and coloured the most deadly of the poisonous ones, *Amanita phalloides* or the Death Cap, is easily mistaken for a mushroom. It grows mostly in woods, however, where mushrooms are rare, and its gills are permanently white, whereas those of the mushroom never are.

F. C. Atkins has the following note in *Everybody's* (3.11.51) : As a grower of cultivated mushrooms—which have never killed anyone —I feel the time has come to define the term " *mushroom* " more accurately . . . . . Could we not return to the understanding, common when I was a boy, that " mushrooms " are safe to eat and " toadstools " are not ?

L. F. LAMBERT REPLIES

Mr. L. F. Lambert, the well-known spawn-maker in Coatesville, Pennsylvania, writes to the Editor :

In the M.G.A. Bulletin of May, 1952, on page 136, under the heading "American News Letter," Dr. J. W. Sinden states " Mr. L. F. Lambert was not the originator of pure culture spawn as reported."

Dr. Sinden is right. I am not the originator of pure culture spawn, and never made such a broad claim. But I do claim I was the first in the United States to make spore culture bottle spawn, which is now used universally by commercial growers. I have made it in wholesale quantities ever since 1916 by my original process.

I am fully vindicated in my claim by Dr. B. M. Duggar's statement as late as 1920 in his book " Mushroom Growing," in which he states on page 106 :

" I have not abandoned the hope that a practical spore method may be developed in this country, but even should such a method be found, it is not at all certain that it would be more practicable than the tissue culture method which has been the first cause of the rapid development of mushroom growing in this country in recent years."

Since you seem interested in knowing all the facts, I am sending you this additional information.

With all best wishes to your organization.

W. A. B. HARDING looks back on . . . . . .

A Year of Area Meetings

Looking back on the first year in which Area Meetings have been regularly held by the Kent/Surrey/East Sussex Group, I feel sure all will agree that they have proved their worth beyond doubt.

They have definitely assisted the objectives of the Association. They have enabled growers to meet and make friends in the Mushroom Industry. They have provided opportunities for members to discuss freely and informally their problems and solutions. They have resulted, by some personal persuasions, in increased membership.

In this Group we have found that **Saturday** meetings have been most popular because many growers cannot leave their farms at any other time.

The clerical administrative side was our main problem until the wives of two Group members generously offered to take on the joint and honorary office of Secretary-Treasurer. We have been helped particularly by the independent compilation of a comprehensive mailing list of all known growers in the Area, including non-members.

The choice of farms has been limited by the modesty of members over their suitability for such gatherings, but in all cases their fears have turned out to be baseless. Many visitors have discovered solutions to problems which were troubling them. Non-members have seen one of the more tangible advantages of M.G.A. membership. All have enjoyed the social atmosphere.

(*How much stronger would the Association be, if only other Groups would follow the fine example of this South-Eastern Group !*—EDITOR.)

Reflections on the Tray System

By **W. A. B. HARDING**

In the January Bulletin, Mr. Middlebrook's Diary notation for September 29 suggested he might be allotted a page to discuss the economics of trays. I hope it will soon be granted him. (*The Editor awaits his pleasure.*)

On this farm, the tray system was given a prolonged trial over a period of three years, at the outset with an open but dubious mind. It resulted in (*a*) the small mushrooms experienced by many growers and (*b*) a lower yield than anticipated.

Corner posts with a protuberance of $1\frac{1}{2}$ inches were fitted in an endeavour to reduce the incidence of small mushrooms, and the more efficient ventilation certainly gave better quality, but the yield did not materially improve.

On an identical bed area and with tray depths of compost varying from 4″ (standard tray) to 6″ or 7″ (standard shelf), the tray beds in every instance did not yield as well as the shelf beds.

When peak heated in the growing room *in position on the shelves*, they did not attain the same temperature in spite of a comparable depth of compost and the presence of normal shelf beds in the same house.

Next, a trial was instituted in which the method of stacking in the cropping room was changed with the object of increasing the airflow over the trays for the entire length of the house without the interruption caused by the usual staggered formation. To achieve this, the trays were placed alongside one another on shelves after leaving the pasteurising room ; these " shelves " were spaced six inches closer than is usual with shelf beds.

There was a marked improvement in quality and weight of individual mushrooms compared with those in trays stacked in staggered formation.

In summary, it has been found on this farm that five tray crops (6″ beds) per year do not yield as much as three orthodox shelf crops (7″ beds) giving nearly 2 lb./sq. ft. Even with a shallower depth of compost the trays annually use more manure and therefore require more labour in composting and filling, to say nothing of the costly replacement of trays.

Unless carried out on an extensive scale, far larger than the average at present worked in Britain, and highly mechanised as advised by Dr. Sinden, we believe it would appear that this is not a universal and unfailing method of increasing production ; some farms (and growers) are probably less adaptable to the technique. We also believe that the allegedly ' cheap ' tray is an uneconomic proposition even as a short-term policy at the inflated price caused by the sudden huge demand of this blind rush and craze for the system.

These used boxes are also open to some risk as regards weed fungi as they are difficult to clean efficiently before putting into service ; there has been evidence of quite an amount of trouble from the growth of ' cat's ear ' fungus.

In the writer's humble opinion it would seem in effect that the road to increased yields and lower production costs is to work on the economics of composting, such as Mr. Middlebrook's ' short method,' which saves wastage ; to improve ventilation where possible in existing buildings ; and to erect better-designed houses when developing, preferably 1,000 sq. ft. units for optimum working and growing conditions.

By so doing, it would appear that on most farms on the ' specialised ' system the shelf system would prove as a general rule superior to the tray system as now practised in Britain. But I would add that, as some of our tray growers appear to be very successful, our unfavourable results might have been due to conditions on this farm unfavourable to the tray method.

SCIENCE AND THE GROWER

Unsolved Problems and the Value of Research

by P. B. Flegg

An unambitious grower, getting good yields without any disease, soil or other cultural problems, might find it difficult to see how he can benefit from research and an advisory service. A grower with problems, as most are, will no doubt be glad of help in combatting disease or improving his compost or soil. Such problems, although very urgent when they arise, are generally only transient and can often be overcome in a relatively short time.

It must be a very complacent and easily satisfied grower who does not wish for even higher yields, greater efficiency and reductions in production costs.

The application of scientific knowledge and research, as well as playing a part in the surmounting of difficulties such as disease, poor soil and compost conditions, can play another wider role.

The answers to such questions as : " Why do mushrooms produce fruiting bodies when a compost is cased ?" and " Why does a house cease cropping at a certain time when there is obviously still a latent capacity to produce in the beds ?" would give a much wider understanding of the whole problem. Given this, it would then be possible to determine more accurately the optimum conditions required for cropping.

While such questions as these remain unanswered we cannot be sure that however well the beds produce they are producing at the maximum rate.

That mushroom compost will not produce fruiting bodies in any quantity until cased with a suitable material is well-known. Even when cased with what is known to be a good suitable material, mushrooms are not always forthcoming. Sometimes the mycelium will continue growing from the compost into the soil and the condition known as stroma arises; why is this ? It is true that stroma can often be controlled successfully, but exactly why it happens or exactly how the treatment applied effects a cure is not known.

During the work on synthetic composts a great deal of valuable information on the nutritional requirements in terms of nitrogen,

phosphorus, potassium and trace elements has been built up and it is now possible to produce from chemicals and a basic material such as wheat straw a compost which will give good yields under the right cultural conditions. However, more work is needed to find out if this compost cannot be improved even further from the point of view of yield or cost of production.

While the bed is cropping how do we know that the watering and other treatment given is the best treatment ? It may be that the present treatment gives 3 lb. a square foot but it cannot be said that this may not be improved by some alteration or even more careful control of watering.

That watering can affect the yield has been shown recently in some pot experiments at Yaxley. The same soils subject to several levels of watering, and different intervals between waterings, showed that amount of water and interval between waterings had an appreciable effect on both the number and weight of mushrooms produced. At best the grower has to find out for himself by trial and error what sort of watering treatment produces the best results. The trial and error system often proves very expensive to the grower and a more satisfactory means of determining the optimum watering conditions for a given soil is required.

Cropping on even the best of composts and with the best of soils eventually falls off and the house has to be renewed. Why does cropping cease ? There is still food available in the compost for the mushroom ; this is shown by instances of beds being thrown out or disturbed in some way and a fresh crop of mushrooms appearing. As with other such questions there are several tentative theories and answers but it is not possible to say with any degree of certainty which are the factors contributing to a cessation of fruiting. When these factors can be defined the possibility of prolonging the profitable cropping period may well arise.

This review of some of the many as yet unanswered questions facing the research worker will show that there is still much to be learnt about the cultivation of mushrooms—even if all problems of disease, insects and unsuitable materials were overcome.

These questions are not of the type that can be solved by the laying down of a simple experiment and the answer being revealed at the end of cropping. Many experiments on both a small and large scale are needed, together with laboratory examination of the materials used. In common with research on other problems progress is slow. Nature gives up her secrets reluctantly, but with time and patience progress is made.

BHC AND FUNGI

The April, 1952, Review of Applied Mycology prints an abstract from the Journal of Economic Entomology in which H. G. Simkover and R. D. Shenefelt report that, in preliminary tests at the Winconsin Agricultural Experiment Station, crude benzene hexachloride caused a marked inhibition of mycelial growth when sprinkled over agar slants of *Rhizoctonia*. Similarly, the gamma isomer at the rate of 1 lb. per acre controlled damping-off of a virulent strain of the fungus in Norway pine seedlings ; above 1 lb. per acre the compound caused severe root clubbing.

TWO FARM WALKS IN JULY

By kind invitation of Mr. T. M. Dowmunt, a visit to Holly Grove Mushroom Farm, Newick, Sussex, has been arranged for 3 p.m. on Saturday, 5th July, by the Kent, Surrey and East Sussex Area Committee. Please notify Yaxley at once if you wish to attend.

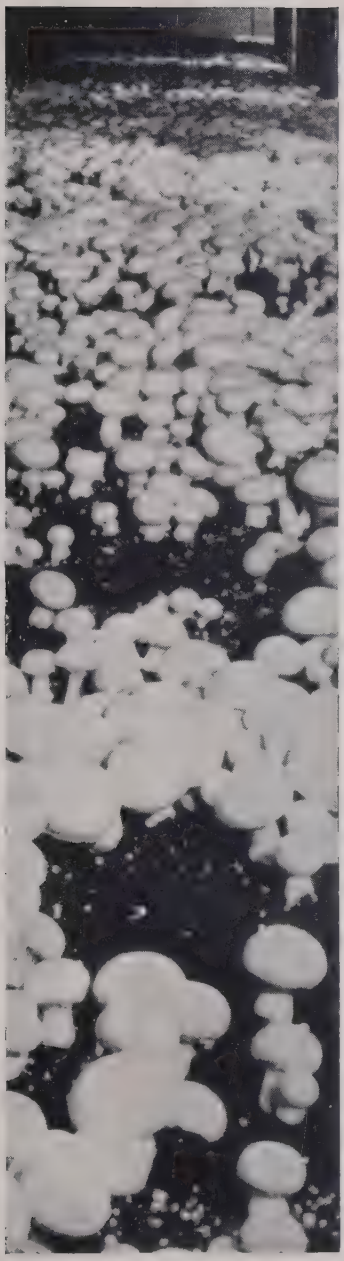
The M.G.A. Chairman, Mr. J. Stewart-Wood, invites members within a reasonable distance of Aylesbury to see his tray farm at Ford, nr. Aylesbury, at 2 p.m. on Tuesday, 15th July. Tea will be arranged for those who notify Yaxley at once of their plans. Tea will be followed by a short, informal discussion until 6 p.m. A nominal charge of 5/- is being made.

CONGRATULATIONS to Mr. G. C. Johnson, Deputy Provincial Director of the N.A.A.S. at Cambridge, on his O.B.E.; to Mr. A. A. Richards, Nursery Manager and Demonstrator at Cheshunt Research Station, on his M.B.E.; and to Lt.-Col. W. E. Shewell-Cooper, of the Horticultural Bureau, Thaxted, on his Vienna Doctorate.

SOIL PROBLEM IN YORKSHIRE

Soil on West Riding rhubarb farms has been heavily dressed with ash for generations, and is liable to produce dirty mushrooms, so this year soil is being imported from a Southport river bed and used for casing. With the co-operation of Leeds University, the soil is to be analysed and a search made for a local soil with the same properties.

Yorkshire Evening News, 23.5.52.



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